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ABSTRACT

Two hundred sixty-five subjects learned a mixed list of paired associates in an AB, AD and AB, CD transfer paradigm. Two levels of semantic processing were factorially varied across original and interpolated pairs. Recall of original pairs was shown to be directly related to the processing depth of original pairs in both paradigms and inversely related to the processing depth of interpolated pairs in the AB, AD paradigm, but not in the AB, CD paradigm. Twenty additional subjects intentionally learned and recalled the same list and showed significant retroactive inhibition for original pairs in the AB, AD paradigm. The findings indicate that interference does not occur in a mechanical fashion, but is sensitive to subjects' level of perceptual analysis of the pairs. (Author)

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RI AT TWO LEVELS OF SEMANTIC PROCESSING

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A. Introduction

Beginning in the 1940's with the classic study of Melton and Irwin (5) and continuing through the 1960's, much of the research in the area of human learning was conducted within the framework of interference theory. A focus of this research has been the weakening or unlearning of S-R associations in a more or less mechanical manner due to the acquisition of new associations. Few investigators treated the learning situation as one in which subjects were active information processors trying to optimize their performance on the learning and recall tasks.

Recently, however, Craik and Lockhart (1) have proposed an information processing model of memory in which memory is seen as a by-product of perceptual analyses--a continuum ranging from the products of a sensory analysis of physical features to memory traces resulting from deeper semantic analyses. Retention is hypothesized to be related directly to the level of perceptual processing of the to-be-recalled material; attending to physical features of stimuli constitutes shallow processing, while attending to semantic-associative features constitutes deeper processing and results in better subsequent recall. Epstein and his colleagues (2,3) supported a level of processing model of memory by showing that orienting subjects toward similarities or differences in the meanings of paired associates resulted in recall of the pairs at a level equal to or better than that of intentional-learning controls.

The present study investigated RI at two levels of semantic processing. It was predicted that rather than proceeding in a mechanical fashion, the amount of RI would vary as a function of the orienting instructions given

to subjects in the processing of paired associates. Specifically, following incidental, semantic orienting instructions, RI in an AB,AD transfer paradigm was predicted to be related directly to the processing level of interferring pairs and inversely related to the processing level of original pairs. In addition since there are no specific interferring associations in the AB,CD transfer paradigm, recall of AB pairs was predicted to reflect only the level of processing of the original and not the interpolated pairs.

B. Method

Subjects

Five groups of male and female introductory psychology students (285 in all) at Rider College fulfilled a course requirement by participating in the study.

Procedure

Subjects were shown a series of 40 slides, each for 10 seconds, and asked either to find differences in the meanings of the pairs of related concrete nouns on each slide or to rate the average pleasantness of the paired words on a scale from 1 to 7. Subjects were signalled of the appropriate task by the presence or absence of a row of dots on the slides. For half of the subjects the presence of dots was the signal to find differences in the meanings of the words and the absence of dots was the signal to rate the pleasantness; for the other half of the subjects the meaning of the signals was reversed.

While both finding differences in the meanings of related word pairs and rating word pleasantness are semantic orienting tasks, previous research has shown that greater processing depth is achieved by the former (4).

Eight of the slides in the first half of the series of 40 slides formed an AB,AD transfer paradigm with eight in the second half; the latter word pairs had the same first word as those in the first half of the series but had a different second word. Eight other slides in the first half of the list formed an AB,CD paradigm with pairs in the second half, creating, then, a mixed-list design (6). Eight additional slides (four in the first half of the list; four in the second half) were fillers and did not enter into the analyses of the data.

Four conditions were constructed in which the depth of first- and second-half processing was factorially varied across two transfer paradigms. That is, the conditions formed were Deep-Deep, Deep-Shallow, Shallow-Deep, and Shallow-Shallow representing processing depth of first- and second-half pairs, respectively, for both the AB,AD and AB,CD paradigms. A fifth condition in which subjects were instructed to "try to learn" the word pairs presented in the same manner as in the other conditions served as a control group to measure RI under intentional-learning instructions. Word pairs were counterbalanced so first-half pairs in the AB,AD paradigm for half of the subjects were in the AB,CD paradigm for the other half of the subjects.

Following processing a surprise modified free recall (MMFR) test was administered in which subjects were presented with a sheet of paper containing both members of all second-half pairs but only the first member of each first-half pair. Five minutes were allotted for subjects to recall and associate correctly the missing response items.

C. Results and Conclusions

Recall scores for the different conditions are summarized in Table 1. The data were analyzed in a 2x2x2 analysis of variance for mixed designs. The factors represent transfer paradigm (AB,AD or AB,CD; a within-subjects factor), first-half depth (deep or shallow; a between-subjects factor), and second-half depth (deep or shallow; a between-subjects factor). It can be seen that recall of first-half pairs was better following deeper processing of those pairs regardless of the transfer paradigm [$\bar{X}_{deep1}$ = 6.50, $\bar{X}_{shallow1}$ = 5.08, F (1,261) = 64.90; $p < .001$]. Conversely, recall for first-half pairs was poorer when interferring pairs in the second of the list were processed deeply compared to when they were more shallowly processed [$\bar{X}_{deep2}$ = 5.58, $\bar{X}_{shallow2}$ = 5.99, F (1,261) = 6.52; $p < .01$]. Both of the above findings support a levels of processing model of memory (1) in which more deeply processed items are thought to be more available for immediate recall and less susceptible to decay.

The differential effect of transfer paradigm upon recall is seen by overall better recall for first-half pairs in the AB,CD paradigm compared to those in the AB,AD paradigm [$\bar{X}_{AB,CD}$ = 6.56, $\bar{X}_{AB,AD}$ = 5.00, F (1,261) = 193.43; $p < .001$]. In addition it was expected that regardless of first-half processing depth, recall for first-half pairs in the AB,CD paradigm would not be affected as much by the processing depth of second-half pairs as would first-half pairs in the AB,AD paradigm. Since there are no specific interferring associations in the AB,CD paradigm, recall for first-half pairs would be expected to be equal in the Deep-Deep and Deep-Shallow conditions. However unlearning of specific (AB) associations is hypothesized to occur in the AB,AD paradigm; thus the processing level of second-half pairs would be expected to affect first-half recall with poorer recall

following deeper second-half processing. Specifically, recall for first-half pairs in the AB,AD paradigm would be expected to be better in the Deep-Shallow condition than in the Deep-Deep condition and better in the Shallow-Shallow condition than in the Shallow-Deep condition. As seen in Table 1 the above predictions were supported. The finding of a significant transfer paradigm by second-half processing depth interaction [F (1,261) = 10.43; $p < .001$] shows that recall of first-half pairs in the AB,CD paradigm was relatively unaffected by the processing depth of second-half pairs regardless of the depth of first-half processing.

In order to apply the present findings to other interference studies it is important that the single, split-list interference paradigm used here be shown to generate RI in the AB,AD condition under standard learning instructions. Typically, two separate paired-associate lists are presented to subjects in interference studies, an original-learning (AB) list and an interpolated (AD or CD) list separated by a short time interval. The intentional-learning controls in the study reported here were run in order to test the validity of the present learning task in producing RI; these controls showed significant RI in the recall of first-half pairs in the AB,AD paradigm relative to pairs in the AB,CD paradigm [$\bar{X}_{AB,AD} = 4.70$, $\bar{X}_{AB,CD} = 5.45$, t (19) = 2.14; $p < .05$].

Thus the experimental hypotheses were supported by the finding of varying resistance to RI as a function of processing depth of first- and second-half pairs. The significant paradigm by second-half processing depth interaction indicated that recall for first-half pairs in the AB,AD (unlearning) paradigm was inversely related to processing depth of AD pairs, whereas recall for first-half pairs in the AB,CD paradigm was

independent of the processing depth of CD pairs. It is inappropriate, then, to consider RI as due to the mechanical or automatic weakening of S-R associations; one must take into account the more cognitive issues of processing depth of original and interferring pairs.

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Table I

Number of pairs recalled (out of 8) as a function of processing depth and transfer paradigm.

Processing depth		Transfer Paradigm		
1st list	2nd list	AB,CD	AB,AD	Marginal means
deep	deep	7.17	5.46	6.32
deep	shallow	7.26	6.15	6.70
shallow	deep	5.86	3.76	4.81
shallow	shallow	5.97	4.71	5.34
Marginal means		6.56	5.00	5.78